PCT / IB 03 / 00030

Sertifikaat
PATENTKANTOOR

25. 02. 03 *Certificate*
PATENT OFFICE

REPUBLIC OF SOUTH AFRICA

REPUBLIEK VAN SUID-AFRIKA

DEPARTEMENT VAN
HANDEL EN NYWERHEID

DEPARTMENT OF TRADE
AND INDUSTRY

0 JUL 2004

Hiermee word gesertifiseer dat
This is to certify that

the documents attached hereto are true copies of the Forms P2, P6, provisional specification and drawings of South African Patent Application No. 2002/0220 in the name of De Beer Industrial Diamonds Division (Pty) Ltd with a subsequent change of name to Element Six (Pty) Ltd on 10 January 2003

Filed : 10 January 2002

Entitled : Method of making a Tool Component

Geteken te PRETORIA in die Republiek van Suid-Afrika, hierdie 7th dag van February 2003
Signed at in the Republic of South Africa, this day of

Registrateur van Patente
Registrar of Patents

PRIORITY DOCUMENT
SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

FORM P.2

REPUBLIC OF SOUTH AFRICA	REGISTER OF PATENTS	PATENTS ACT, 1978

OFFICIAL APPLICATION	LODGING DATE: PROVISIONAL	ACCEPTANCE DATE
21 01 2002/0220	22 10 JAN 2002	47
INTERNATIONAL CLASSIFICATION	LODGING DATE: COMPLETE	GRANTED DATE
51	23	

FULL NAME(S) OF APPLICANT(S)/PATENTEE(S)

71 ~~DE BEERS INDUSTRIAL DIAMONDS (PROPRIETARY) LIMITED~~ NAAM VERANDER NAME CHANGED
ELEMENT SIX (PTY) LTD 9.01.03

APPLICANTS SUBSTITUTED:	DATE REGISTERED
71	

ASSIGNEE(S)	DATE REGISTERED
71	

FULL NAME(S) OF INVENTOR(S)

72 TANK, KLAUS

PRIORITY CLAIMED	COUNTRY	NUMBER	DATE
N.B. Use International abbreviation for country (see Schedule 4)	33 NIL	31 NIL	32 NIL

TITLE OF INVENTION

54 METHOD OF MAKING A TOOL COMPONENT

ADDRESS OF APPLICANT(S)/PATENTEE(S)

SEO BUILDING, CORNER CROWNWOOD & BOOYSENS RESERVE ROADS, THETA, JOHANNESBURG, 2001, GAUTENG, SOUTH AFRICA

ADDRESS FOR SERVICE	S & F REF
74 SPOOR & FISHER, SANDTON	PA131822/P

PATENT OF ADDITION NO.	DATE OF ANY CHANGE
61	
FRESH APPLICATION BASED ON	DATE OF ANY CHANGE

SPOOR & FISHER

REPUBLIC OF SOUTH AFRICA FORM P.1
REVENUE
10.01.02
R 0060,00
HASR 505
INKOMSTE
REPUBLIEK VAN SUID-AFRIKA

REPUBLIC OF SOUTH AFRICA
PATENTS ACT, 1978

APPLICATION FOR A PATENT

AND ACKNOWLEDGEMENT OF RECEIPT
(Section 30 (1) – Regulation 22)

The granting of a patent is hereby requested by the undermentioned applicant on the basis of the present application filed in duplicate

OFFICIAL APPLICATION NO.		S & F REFERENCE
21 01	2002/0220	PA131822/P

NAAM VERANDER
NAME CHANGED 9.1.03

FULL NAME(S) OF APPLICANT(S)

71	~~DE BEERS INDUSTRIAL DIAMONDS (PROPRIETARY) LIMITED~~ ELEMENT SIX (PTY) LTD

ADDRESS(ES) OF APPLICANT(S)

	SEO BUILDING, CORNER CROWNWOOD & BOOYSENS RESERVE ROADS, THETA, JOHANNESBURG, 2001, GAUTENG, SOUTH AFRICA

TITLE OF INVENTION

54	METHOD OF MAKING A TOOL COMPONENT

THE APPLICANT CLAIMS PRIORITY AS SET OUT ON THE ACCOMPANYING FORM P.2. THE EARLIEST PRIORITY CLAIM IS:

COUNTRY:	NUMBER:	DATE:
NIL	NIL	NIL

~~THIS APPLICATION IS FOR A PATENT OF ADDITION TO PATENT APPLICATION NO.~~

21	01	

~~THIS APPLICATION IS A FRESH APPLICATION IN TERMS OF SECTION 37 AND IS BASED ON APPLICATION NO.~~

21	01	

THIS APPLICATION IS ACCOMPANIED BY:

- ☒ 1. A single copy of a provisional specification of 6 pages.
- ☒ 2. Drawings of 1 sheet.
- ☐ 3. Publication particulars and abstract (Form P.8 in duplicate).
- ☐ 4. A copy of Figure of the drawings (if any) for the abstract.
- ☐ 5. Assignment of invention.
- ☐ 6. Certified priority document.
- ☐ 7. Translation of the priority document.
- ☐ 8. Assignment of priority rights.
- ☐ 9. A copy of the Form P.2 and the specification of S.A. Patent Application No .
- ☐ 10. Declaration and power of attorney on Form P.3.
- ☐ 11. Request for ante-dating on Form P.4.
- ☐ 12. Request for classification on Form P.9.
- ☒ 13. Form P.2 in duplicate.
- ☐ 14. Other.

74	ADDRESS FOR SERVICE: SPOOR & FISHER, SANDTON

Dated: 10 January 2002

SPOOR & FISHER
PATENT ATTORNEYS FOR THE APPLICANT(S)

RECEIVED
REGISTRAR OF PATENTS, DESIGNS, TRADE MARKS AND COPYRIGHT
2002 -01- 10
REGISTRATEUR VAN PATENTE, MODELLE, HANDELSMERKE EN OUTEURSREG
REGISTRAR OF PATENTS

SPOOR & FISHER

FORM P.6

REPUBLIC OF SOUTH AFRICA
PATENTS ACT, 1978

PROVISIONAL SPECIFICATION

(Section 30(1) – Regulation 27)

OFFICIAL APPLICATION NO.		LODGING DATE	
21 01	2002/0220	22	10 JANUARY 2002

FULL NAMES OF APPLICANTS

71	~~DE BEERS INDUSTRIAL DIAMONDS (PROPRIETARY) LIMITED~~ ELEMENT SIX (PTY) LTD 9.1.03

NAAM VERANDER
NAME CHANGED

FULL NAMES OF INVENTOR

72	TANK, KLAUS

TITLE OF INVENTION

54	METHOD OF MAKING A TOOL COMPONENT

BACKGROUND OF THE INVENTION

This invention relates to a method of making a tool component.

Tool components utilising diamond compacts, also known as PCD, and cubic boron nitride compacts, also known as PCBN, are extensively used in drilling, milling, cutting and other such abrasive applications. The tool component will generally comprise a layer of PCD or PCBN bonded to a support, generally a cemented carbide support. The PCD or PCBN layer may present a sharp cutting edge or point or a cutting or abrasive surface.

United States Patent 6,063,502 describes a material useful for producing the abrasive layer of a tool component. The material comprises a first structural phase comprising a hard material selected from the group consisting of cemented carbide materials, PCD, PCBN and mixtures thereof, and a second structural phase comprising a material that is different to that used to form the first structural phase, the second structural phase being in contact with at least a portion of the first structural phase. The material includes repeated structural units, disposed across a working surface of the material, each unit comprising an ordered micro-structure of the first and second structural phases. In use, this material is applied to a surface of a substrate and then bonded to that substrate.

This United States patent describes various methods of producing the material. One such method comprises producing a plurality of fibres having a core of the first structural phase and a coating of the second structural phase, orienting the fibres parallel to a common axis and then extruding them into a rod. The extruded rod can be cut into a desired geometry for the tool component or sliced to form a cutting surface for placement on to a substrate.

SUMMARY OF THE INVENTION

According to the present invention, a method of producing a tool component includes the steps of:

(1) providing a plurality of fibres, each fibre having a core comprising a mass of ultra-hard abrasive particles and optionally a second phase, and a coating comprising a mixture of carbide particles and particulate binder metal,
(2) producing a bundle of the fibres,
(3) severing the bundle transverse to its length to produce a layer,
(4) placing the layer on a surface of a substrate, and
(5) subjecting the layer and substrate to elevated temperature and pressure conditions at which the ultra-hard abrasive particle is crystallographically stable.

The product which is produced is a tool component comprising the substrate having a working portion produced from the layer bonded to a surface thereof. The working portion comprises a composite material comprising essentially a honeycomb structure of cemented carbide and abrasive compact material within the pores of the honeycomb structure and bonded to the honeycomb structure. The pores of the honeycomb structure may be ordered or random.

The composition of the core and coating may be interchanged in the method described above. Such a method forms another aspect of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Figures 1 to 6 illustrate schematically steps in an embodiment of the invention.

DESCRIPTION OF EMBODIMENTS

The ultra-hard abrasive particles will generally be diamond or cubic boron nitride. Thus, the abrasive compact which is produced in the pores of the honeycomb structure will preferably be PCD or PCBN. That PCD or PCBN will preferably contain a second phase which will typically be a solvent/catalyst for the ultra-hard abrasive particle.

The particulate components of the core and coating of the fibres will preferably be in bonded form using a bonding agent such as an organic binder. An example of a particularly suitable binder is methyl cellulose. Generally, this binder will be removed, e.g. by heating, prior to subjecting the substrate and layer to the elevated temperature and pressure conditions.

The carbide particles will typically be tungsten carbide particles, tantalum carbide particles or molybdenum carbide particles. The metal binder may be any metal binder known in the art such as iron, nickel, cobalt or an alloy containing one or more of these metals.

The layer which is applied to a surface of the substrate is in a green state form. As such, it has a flexibility and may be applied to surfaces which are flat or

profiled, e.g. a curved surface. The layer may be moulded into a shape complimentary to the substrate to which it is to be bonded.

The substrate will typically be a cemented carbide substrate.

An embodiment of the invention will now be described with reference to the accompanying drawings. Referring first to Figure 1, there is shown a fibre comprising a core 10 and a coating 12. The core 10 comprises a mixture of diamond particles and a diamond solvent/catalyst, in particulate form, bonded into coherent form by means of an organic binder. The coating 12 comprises a mixture of carbide particles and metal binder, in particulate form, again bonded into coherent form by means of an organic binder.

The fibre of Figure 1 is reduced in cross-section by extruding it through nozzle 14 (see Figure 2). A plurality of the fibres 16 extruded through nozzle 14 are then placed in a sleeve 18. The sleeve 18, containing the bundle of fibres 16, is then extruded through nozzle 14 as shown in Figure 4. The extruded product is a rod 20 comprising the fibres 16 pressed into each other, as shown in Figure 5. This rod 20 may then be severed in a direction transverse to its length, as shown by the dotted lines 22. The severed piece or layer 24 may be removed. Thus, the layer 24, which has flexibility, may be placed on the curved surface 26 of a substrate 28, as shown in section by Figure 6.

The green state product of Figure 6 is placed in a suitable capsule for insertion into the reaction zone of a conventional high temperature/high pressure apparatus. The organic binder is first removed by heating the capsule to drive off the binder. The capsule is then placed in the reaction zone and the contents of the capsule subjected to diamond synthesis conditions. Typically, the pressure applied will be of the order of 4 to 8 GPa and the temperature will be of the order of 1300°C to 1700°C. This has the effect of producing PCD out of the material of core 10 and cemented carbide out of the material of coating

12. The PCD will be bonded to the cemented carbide. The layer 24 will be bonded to the surface 26 of the substrate 28 producing a working portion for the tool component. The working portion will have a honeycomb structure, similar to that shown by Figure 6, of cemented carbide and PCD within the pores of the honeycomb structure.

Dated this 10th day of JANUARY 2002

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Spoor & Fisher
Applicant's Patent Attorneys

DE BEERS INDUSTRIAL DIAMONDS (PROPRIETARY) LIMITED

ONE SHEET

PROVISIONAL SPECIFICATION

2002/0220

Fig 1

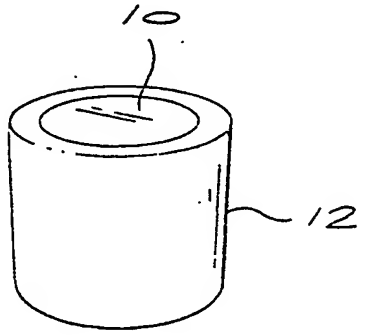


Fig 5

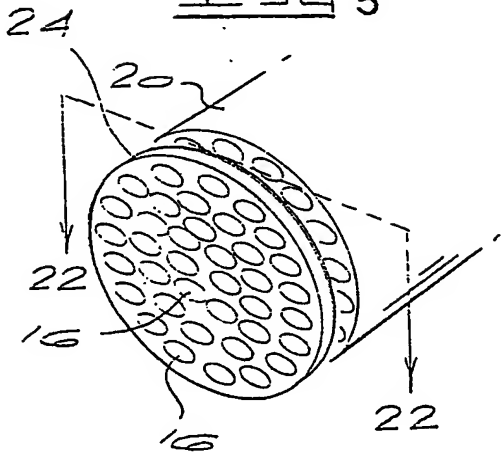


Fig 2

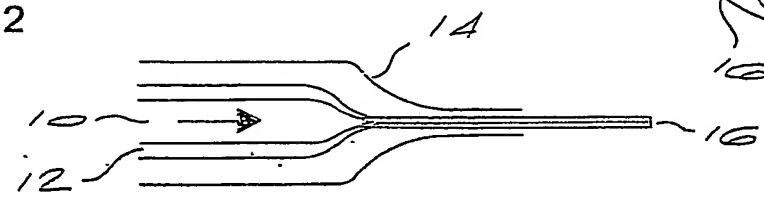
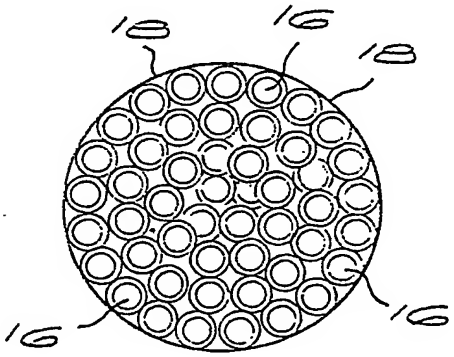


Fig 3



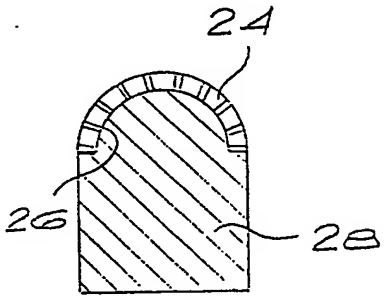
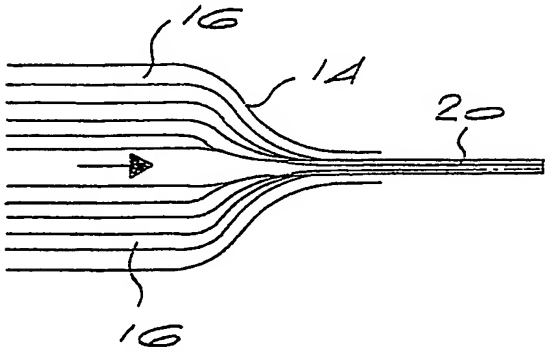


Fig 6

Fig 4



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